The Influence Of Variations In Soaking Time Of Rice Husk Charcoal Briquettes On Its Performance

The Influence Of Variations In Soaking Time Of Rice Husk Charcoal Briquettes On Its Performance

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Abstract. Rice husk is one of the biomass wastes from agriculture which is used as an alternative energy source in the form of briquettes. These briquettes are used as fuel in aluminum stoves. This study aims to analyze the performance of rice husk charcoal briquettes at various times of immersion in kerosene. The research method was carried out using experimental methods by testing rice husk charcoal briquettes on five variations in soaking time, namely 0 minutes, 5 minutes, 15 minutes, and 20 minutes, after testing on an aluminum stove alternately with the process of boiling water. The results showed that the highest flame temperature, ignition duration, ability to boil water, and highest thermal efficiency were 798% at 120 minutes, 24 liters, and 69.88% at 20 minutes of immersion.

1. Introduction

Fuel energy consumption is increasing and is only focused on the use of petroleum fuel which is limited in number, and the price is increasing. So that various breakthroughs are needed to obtain alternative energy sources in addition to the use of fuel oil. Biomass is generally known as dry matter organic material or the material that remains after a plant or organic material has removed its moisture. Biomass is easy to find from agricultural activities, plantations, animal husbandry, fisheries, and other wastes. Biomass waste is one example of biomass energy used in this study, which comes from the agricultural sector, namely rice husk waste. Rice husk is part of the grains (cereals) in the form of dry, noisy, and inedible sheets, which protect the inside (endospermium and embryo). Husks can be found in almost all members of grasses (Poaceae), although in some types of cultivation, there are variations of grains without husks (eg, corn and wheat). In general, rice husk waste is abundant from the rest of the rice mill to become rice, so it can become waste that can interfere with human activities. As for other uses, rice husk can be burned to make ashes, to fertilize plants. So one solution is to make it into briquettes, with good studies to obtain data on the thermal properties of biomass energy, which is an alternative renewable energy for household needs. Several previous studies that used rice husk briquettes as briquette material, namely [1], had conducted research by mixing rice bran, coconut shells, and rice husks to produce a calorific value of 4580 kcal/kg at a ratio of 20:80:10. [2] have conducted a study on a mixture of briquettes from pine nuts and rice husks resulting in a thermal efficiency of 62.7% in a mixture composition of 60:22.5:7.5:7.5 with additives. [3] conducted a study on briquettes mixed with rice husk and cabbage waste, producing a calorific value of 4456 cal/gram. [4]analyzed the physical properties of briquettes made from rice husks in different ratios and evaluated their thermophysical properties to produce a heating value of 16.51 MJ/kg. [5] have also researched a mixture of rice husk and coconut shell briquettes, which obtained a calorific value of 4996 kcal/kg at a ratio of 50:50. [6]have also analyzed a mixture of husks and shells with paper flour additives resulting in a calorific value of 4214.86 kcal/kg

The problem that arises from several studies that have been conducted is that it is still ineffective when rice husk is mixed with similar or different materials in the form of briquette fuel. Therefore, in this study, the authors tried to research rice husk charcoal briquettes by reviewing variations in the soaking time of the briquettes using kerosene so that the resulting level of fuel effectiveness can be used as an

alternative fuel.

2. Materials and Methods

This study collected rice husks from rice mills in the Lembang Kakondongan area, Rantepao. The stove used in this study was made of clay with a diameter of 200 mm and a height of 300 mm. The briquettes used were a honeycomb with a diameter of 65 mm and a height of 45 [7]. The pictures can be seen below:

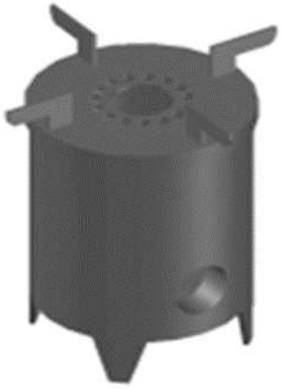

Figure 1. Stove Briquettes

The research method used is experimental by utilizing rice husk in the form of briquettes as fuel for biomass stoves. A series of tests were carried out, starting from testing the charcoal briquettes' physical and chemical properties, then burning the rice husk briquettes on a biomass stove with the water boiling process. Variations in soaking time of rice husk charcoal briquettes with kerosene were 0 minutes, 5 minutes, 10 minutes, 15 minutes, and 20 minutes

3. Results and discussion

The research began with manufacturing rice husk charcoal briquettes, chemical and physical testing of rice husk charcoal briquettes, and combustion testing on a biomass stove with a water boiling process. The parameters used as a reference to see the level of effectiveness of the fuel with 5 types of variations in the time of immersing rice husk charcoal briquettes with kerosene as the initial trigger for combustion are flame temperature, length of time of ignition, ability to boil water, thermal efficiency are as follows.

3.1. Fire Temperature

Figure 2 shows the historical temperature of the fire temperature at five types of soaking times of rice husk charcoal briquettes using kerosene. It can be seen that the highest fire temperature occurred in the combustion chamber at 796°C at 20 minutes of curing time. Second, 15 minutes of immersion time produces a firing temperature of 756°C. The 10-minute immersion time is 612°C; then the 5-minute immersion time is 556°C. Finally, the fire temperature is 496°C at 0-minute immersion time. It can be seen that the process of igniting the fire every time of immersion tends to be unstable because the increase and decrease in temperature are only a few moments. It can be seen that the process of ignition of the fire in the immersion variation, that the longer the soaking time of rice husk charcoal briquettes using kerosene, the greater the fire temperature. This is influenced by the density of the shape of rice husk charcoal briquettes so that they can maintain the flame of the briquettes even longer. This is reinforced by research that has been done using the form of honeycomb briquettes capable of maintaining a flame up to 520°C for 245 minutes [8].

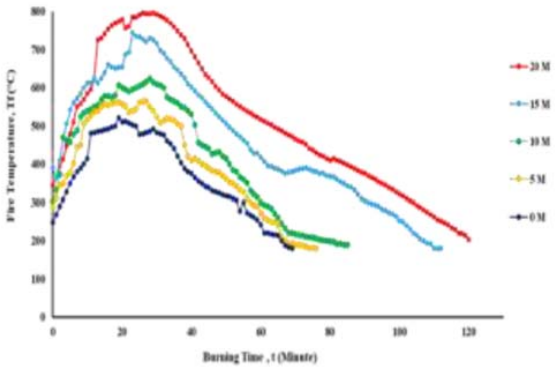

Figure 2. Fire Temperature

3.2. Long Ignition Time

Figure 3 shows the time the fire is ignited with five variations in the soaking time of rice husk charcoal briquettes. It can be seen that the best ignition time is 120 minutes at 20 minutes of immersion. The second immersion time is 15 minutes, with ignition for 112 minutes. Third, the duration of the fire is up to 85 minutes; the immersion time is 10 minutes, then the immersion time is 5 minutes for 76 minutes. Finally, the 0-minute immersion time is only 69 minutes. The longer the soaking time of the rice husk charcoal briquettes, the longer the ignition of the resulting fire. This is reinforced by research that has been conducted comparing stove materials (clay, steel, and aluminum), resulting in a flame temperature of up to 796°C [9].

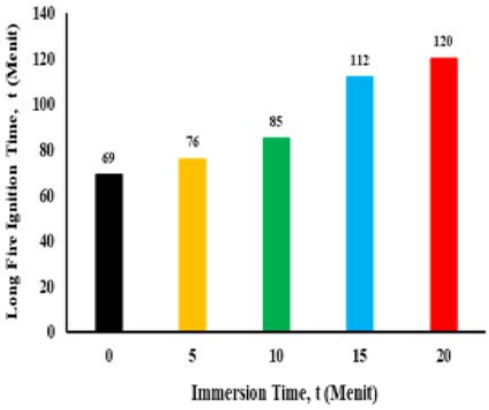

Figure 3. Long Ignition Time

3.3. The Ability To Boil Water

Figure 4 shows the variation of soaking time on the ability to boil water. It can be seen that the ability to boil the most water is 24 liters (six times the process of boiling water) at 20 minutes of immersion. Both soaking times are 15 minutes, as much as 20 liters (5 times the process of boiling water). Third, the soaking time of rice husk charcoal briquettes for 10 and 5 minutes was 16 liters (4 times the water boiling process) and 12 liters (three times the water boiling process). Finally, the ability to boil water is only 8 liters (twice the process of boiling water) at 0 minutes of immersion. The higher the water temperature and the longer the ignition time, the more the water boiling process will result from the long soaking time carried out on the biomass charcoal briquettes. The reinforced by research carried out by [10], resulting in the highest fire temperature of 796°C produced by a clay stove which is directly proportional to the ability to boil 30 liters of water (six times the process of boiling water).

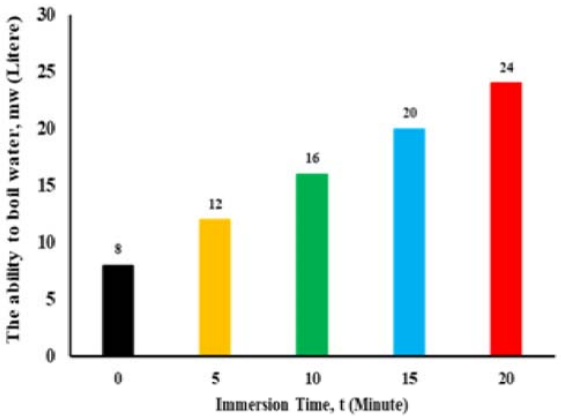

Figure 4. The AbilityTo Boil Water

3.4. Thermal Efficiency

Figure 5 shows the immersion time on thermal efficiency. It can be seen that the highest thermal efficiency is 69.88% at 20 minutes of immersion. The two immersion times of 15 minutes and 10 minutes resulted in a thermal efficiency of 52.11% and 41.78%, respectively. Finally, immersion times of 5 and 0 minutes were 23.14% and 16.78%, respectively. The longer the soaking time of rice husk charcoal briquettes, the higher the thermal efficiency produced. Is reinforced by research that has been done [11], resulting in the highest efficiency of 73.66% with a long ignition time of 6 hours.

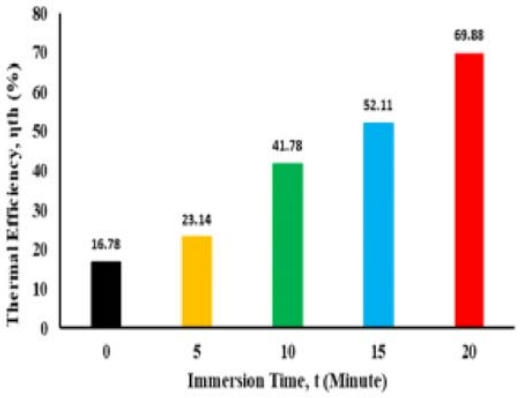

Figure 5. Thermal Efficiency

4. Conclusions

Based on the results of the research and discussion carried out by varying the immersion time of rice husk charcoal briquettes with kerosene, it can be concluded that the longer the rang briquette soaking time, the higher the performance of the stove produced with several test parameters that have been analyzed such as flame temperature, length of time of ignition. , the ability to boil water, and thermal efficiency of 796°C, 120 minutes, 24 liters, and 69.88%, respectively, at 20 minutes of immersion.

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